

ABSTRACT

Apparatus for active in situ multi-element gas sparging for bioremediation or physico-chemical degradation for removal of contaminants in a soil formation containing a subsurface groundwater aquifer or a substantially wet unsaturated zone, the multi-gas contained in bubbles, wherein the apparatus includes a plurality of injection wells extending to a depth of a selected aquifer; introducing an oxidizing agent comprising ozone mixed with ambient air to provide a multi-element gas by means of microporous diffusers, without applying a vacuum for extraction of stripped products or biodegradation by-products, wherein said diffusers form micro-fine bubbles containing said multi-element gas that oxidizes, by stripping and decomposition, chlorinated hydrocarbons from the aquifer and surrounding saturated soil formation into harmless by-products; also including a pump for agitating water in the well selecting microbubbles, injecting them into the aquifer and effective to alter the path of micro-fine bubbles through a porous solid formation whereby enhanced contact between the oxidizing agent contained in each said bubble by stripping pollutant from solution in ambient water into the mini-atmosphere of each bubble effective to increase the efficiency and speed of remediation of a site.

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